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INTERCOMPARISON OF PYRHELIOMETERS

By HERBERT H. KIMBALL, Meteorologist

During a recent visit of Dr. Ladislas Gorczyński, Director of the Meteorological Service of Poland, to the Central Office of the United States Weather Bureau, an opportunity was afforded to obtain interesting comparisons between several different types of pyrheliometers,[1] the results of which are given in Table 1.

TABLE 1.—*Comparison of Marvin Silver Disk pyrheliometer, with Moll and Weather Bureau thermoelectric recording pyrheliometers, June 7, 1924*

Solar time	Marvin No. 3 (gr.-cal.)	Thermoelectric pyrheliometers			Ratio, columns 2/4	Ratio, columns 2/5
		Moll		Weather Bureau scale		
		Scale	Millivolts			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0:28	1.198	5.19	20.76	*17.5	0.0576	3.37
0:32	1.184	5.13	20.52	17.2	578	3.35
1:03	1.214	5.31	21.24	18.2	573	3.43
1:07	1.216	5.32	21.28	18.2	571	3.43
1:11	1.204	5.27	21.08	18.0	570	3.42
1:15	1.186	5.20	20.80	17.8	570	3.42
1:19	1.197	5.20	20.80	18.05	575	3.47
1:23	1.182	5.17	20.68	18.0	571	3.48
1:27	1.169	5.13	20.52	17.65	570	3.44
1:31	1.165	5.13	20.52	17.6	568	3.43
1:35	1.172	5.11	20.44	17.85	574	3.49
1:39	1.168	5.09	20.36	18.8	573	3.50
1:43	1.157	5.04	20.16	17.6	573	3.49
Mean ratio					0.0572	3.44

Ångström pyrheliometer No. 105, which was in use at Mount Weather, Va., from 1907 to 1911, and Smithsonian Silver Disk No. 1, were also included in the above comparison. Dr. Gorczyński read Ångström No. 105, and the Smithsonian instrument was read by myself. The Ångström readings were in almost exact agreement with the readings of Marvin No. 3. The Smithsonian instrument, unfortunately, had recently been returned from field work, and the screws that clamp the silver disk during shipment had not been loosened. In consequence, the Smithsonian instrument read low.

Since the departure of Doctor Gorczyński the following comparisons have been obtained between Marvin No. 3 and Smithsonian No. 1.

TABLE 2.—*Comparisons between Marvin Silver Disk Pyrheliometer No. 3 and Smithsonian Silver Disk No. 1*

Date	Smithsonian No, 1	Marvin No. 3	Ratio, $\frac{\text{Marvin}}{\text{Smithsonian}}$
	Gr. cal.	*Gr. cal.*	
June 20	1.030	1.006	0.977
June 25	1.172	1.140	0.973
June 26	1.294	1.267	0.979
June 26	1.318	1.281	0.972
Mean ratio			0.975

Through comparison of the Moll thermoelectric pyrheliometer with an Ångström pyrheliometer reserved by him as a substandard instrument Doctor Gorczyński had previously obtained the factor 0.057 to reduce millivolts recorded by the Moll instrument to gram-calories. Therefore, the comparisons of Table 1 confirm the accuracy of this factor.

From Table 2 it appears that the Marvin pyrheliometer in June, 1924, was reading 2.5 per cent lower than Smithsonian No. 1. Previous comparisons had shown that Ångström No. 105 read 2.4 per cent lower than Smithsonian No. 1. Therefore, as the result of the above comparisons, we conclude that the Moll instrument is still in accord with the Ångström standard, but reads 2.5 per cent lower than the Smithsonian pyrheliometric scale.[2]

It is important to correlate the readings of this Moll instrument with the Smithsonian pyrheliometric scale, since it has been loaned by Doctor Gorczyński to Mr. Andrew Thompson, Director of the Samoan Magnetic and Meteorological Observatory, for use at that island station.

[1] Published descriptions of these several instruments will be found as follows: Ångström pyrheliometer: Astrophysical Jr., 9: 332–335; Smithsonian Silver Disk pyrheliometer: Annals of the Astrophysical Observatory of the Smithsonian Institution, 3: 47–52; Marvin Silver Disk pyrheliometer: MONTHLY WEATHER REVIEW, 1919, 47, 769. Weather Bureau thermoelectric pyrheliometer: MONTHLY WEATHER REVIEW, 1923, 51: 239–242 Moll thermoelectric pyrheliometer. MONTHLY WEATHER REVIEW, 1924, 52: 299–301.

[2] Smithsonian pyrheliometry revised. Smithsonian Misc. Coll. Vol. 60, No. 18 1913.

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INVESTIGATIONS RELATIVE TO THE POLAR FRONT[3]

By J. W. SANDSTRÖM

In connection with the earlier investigations[4] an attempt was made to apply the theory of "cyclone families" in practical weather service work. This test proved especially fruitful of results since the theory contains a very simple and clearly formulated law as to the paths of cyclones. The result of the test was followed with lively expectation.

The theory of cyclone families states, as is well known, that successive cyclones appear in families, so to speak, and with the succeeding depression having its path somewhat to the south of that of the preceding one, until finally the cyclones move tangent to the tropical belt of high pressure. The first members of the family appear in high latitudes and run more and more to the south until they come so far south that cyclonic formation becomes no longer possible. The theory is a consequence of the polar front conception. A cyclone draws the cold polar air behind it and brings the polar front to the south of its own center, and since the succeeding cyclone follows the polar front it must move more to the south. The process is shown by J. Bjerknes and H. Solberg in Figure 12 of their work, "Life Cycle of Cyclones and the Polar Front Theory of Atmospheric Circulation."[5]

The application of the theory in practical weather service is, then, simple enough. From the known path of a cyclone that has just passed, one draws the path of the succeeding cyclone somewhat more to the south and thereby obtains within relatively narrow limits the path which the next depression will take. Only when the path runs in the vicinity of the tropical "high" is there

[3] Translated from *Meteorologische Zeitschrift, Band 41, Heft 2* (February, 1924) by W. W. Reed.

[4] *Meteorologische Zeitschrift, Band 40, Heft 9* (September, 1923).

[5] *Geofysiske Publikationer, Vol. III, Nr. 1*, 1922.